APPENDIX W

Air Quality Analysis in Support of Major New Source

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Texas GulfLink Project
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 PROJECT OVERVIEW

Sentinel Midstream LLC (Sentinel) proposes to construct and operate an offshore Deepwater Port Facility and the related infrastructure capable of transporting crude oil internationally via Very Large Crude Carrying (VLCC) vessels. This will be accomplished through the construction and operation of the proposed Texas GulfLink Deepwater Project consisting of shore based crude oil storage tanks, a 42" pipeline connecting the onshore storage facility to the offshore loading facility, a fully manned offshore loading platform, and two single point mooring (SPM) buoys to accommodate deep draft tankers that can export US produced crude oil to international markets. Figure 1 is a site location map showing the location of the proposed Deepwater Port Facility.

A New Source Review (NSR) applicability evaluation for the offshore Deepwater Port Facility demonstrates that proposed new emissions of Volatile Organic Compounds (VOC) and Nitrogen Oxides (NOx) exceed NSR *de minimis* emission levels. Therefore, the Deepwater Port Facility will be a major source of emissions under NSR. As such, the proposed project requires a federal Prevention of Significant Deterioration (PSD) construction permit following the requirements of 40 CFR 52.21 and a federal Title V operating permit following the requirements of 40 CFR 71. Both the PSD and Title V permit applications are being submitted under separate cover.

The modeling performed is in support of the PSD permit application, and the analyses described herein meet the requirements of 40 CFR 52.21(k). Additionally, the modeling analyses meet National Environmental Policy Act (NEPA) requirements to demonstrate that the proposed operations associated with the Deepwater Port will not result in a violation of the National Ambient Air Quality Standards (NAAQS). As part of NEPA guidance, modeling was performed to account for direct, indirect, and cumulative impacts from the proposed Texas GulfLink Project to satisfy the requirements of the June 2011 *Memorandum of Understanding regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions through the NEPA Process.* Finally, the modeling analyses follows the requirements of the Bureau of Ocean Energy Management's (BOEM) Gulf of Mexico Region (GOMR) air dispersion modeling guidelines (January 2018), which references Appendix W of 40 CFR 51 requirements for conducting the modeling and preparing the report.

Per Deepwater Port Act regulations (33 CFR 148.5), vessels are not considered primary/direct sources of emissions from the Project for Clean Air Act new source review regulatory applicability. Therefore, the modeling analyses address emissions from sources with an indirect impact (e.g. emissions from the VLCC itself, and other emission sources on the VLCC deck) to address the requirement of direct, indirect, and cumulative impacts from the Project.

Because the Deepwater Port (DWP) Act requires that the US EPA have jurisdiction over any DWP facility, this report summarizes a dispersion modeling assessment that determines the air quality impacts on the defined property boundary of the proposed offshore facility and surrounding water, in compliance with federal PSD requirements. Additionally, because Texas is the "nearest adjacent coastal state" to the proposed offshore facility, per DWP Act regulations, this report summarizes impacts determined based on Texas Commission on Environmental Quality (TCEQ) requirements related to fence-line impacts of applicable sulfur compounds and the agency's Health Effects Review procedures for applicable pollutants that have defined Effects Screening Level (ESL) limits.

2.0 POLLUTANTS TO BE MODELED

For the modeling analysis, the estimated potential emissions from emission sources associated with the SPM buoys system operations (including indirect impacts from the crude carrier itself and other emissions sources on the carrier) and the platform were included. The estimated potential maximum hourly emissions from these sources have been utilized for the short-term averaging period models in this dispersion modeling analysis and average hourly emissions for annual averaging periods.

For this modeling analysis, NO_x was modeled using the Tier 1 method from the September 30, 2014 US EPA Guidelines[1], where all NO_x emitted is modeled as nitrogen dioxide (NO_2) (i.e., full conversion of nitric oxide (NO) to NO_2) for the annual averaging period. This is a conservative approach as the majority of NO_x emissions are in the form of NO rather than NO_2.

The types of emission sources that were modeled for the proposed Texas GulfLink Project consist of combustion sources from the loading platform and the Very Large Crude Carrier (VLCC or Carrier) operations, including generators, cranes, and emergency equipment. Additionally, Carrier main and auxiliary engines, boilers, and crane engines were modeled. Finally, support vessels were modeled, including pilot boats, escort tugs, service support boats, and line hose boats. Stack height and other related modeling stack parameters were based on similar equipment that exist in the maritime industry. A worst-case impacts scenario was modeled that addresses a VLCC being loaded at one of the SPMs while another VLCC is transiting into the safety zone with its associated support vessels.

Proposed emergency equipment, including electric generator and firewater pump engines, will be permitted to operate less than 100 hours per year. Because the engines will only be tested less than one hour in any 24-hour period, the engines were modeled based on their annual average rate instead of the short-term maximum hourly rate. This is in accordance with the 2018 BOEM Modeling Guidance and US EPA's guidance for intermittent sources[2]. Table 2-1 shows the model input (maximum hourly) emission rates for the proposed sources of air emissions.

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[1] Memorandum, Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard, US EPA, September 30, 2014.
[2] Memorandum, Additional Clarification regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard, March 1, 2011.

Table 2-1: Stack Parameters and Modeled Emission Rates

Source ID	Source Description	Latitude	Longitude	Base Elevation	Stack Height Above Platform or Water[1]	Temperature	Exit Velocity	Stack Diameter	PM_{10} Emissions 24-hr	PM_{10} Emissions Annual	$PM_{2.5}$ Emissions 24-hr	$PM_{2.5}$ Emissions Annual	NO_x Emissions 1-hr	NO_x Emissions Annual	CO Emissions	SO_2 Emissions ST	SO_2 Emissions Annual	Height of Building	Building Width
		Decimal Degrees	Decimal Degrees	(m)	(m)	K	mps	(m)	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	g/s	m	m
PLATFORM SOURCES																			
G1	Generator 1	28.554283	95.027581	30	6.096	700	39.62	0.15	0.04	0.04	0.04	0.04	1.25	1.25	0.70	0.0013	0.0013	3	3.7
G2	Generator 2	28.554283	95.027581	30	6.096	700	39.62	0.15	0.04	0.04	0.04	0.04	1.25	1.25	0.70	0.0013	0.0013	3	3.7
C1	Crane 1	28.554543	95.027668	39	12.192	728	48.77	0.18	0.02	0.02	0.02	0.02	0.33	0.33	0.31	0.0013	0.0013	0	0
FWP1	Firewater Pump	28.55429	95.02771	21	6.096	746	72.85	0.16	0.02	0.0003	0.02	0.0003	0.003	0.003	0.25	0.0005	0.0000	0	0
SPM 1 - LOADING																			
CAE1	Carrier Aux Diesel Gen Engines	28.541554	94.996868	0	57.912	589	46.33	1.00	0.22	0.18	0.21	0.18	8.99	7.49	2.99	0.38	0.31	0	0
CB	Carrier Boiler	28.541554	94.996868	0	57.912	589	46.33	1.00	0.53	0.01	0.53	0.01	3.86	0.08	0.80	2.28	0.05	0	0
ET1	Escort Tug	28.539742	94.99321	0	10.668	728	76.20	0.37	0.39	0.27	0.38	0.26	12.49	8.67	5.32	0.67	0.47	0	0
SPM 2 - TRANSITTING																			
CME2	Carrier Main Engine	28.540999	94.996172	0	57.912	589	46.33	1.00	1.93	0.27	1.78	0.25	51.00	7.08	4.62	1.10	0.15	0	0
CAE2	Carrier Aux Diesel Gen Engines	28.524141	95.028175	0	57.912	589	46.33	1.00	0.22	0.18	0.21	0.18	8.99	7.49	2.99	0.38	0.31	0	0
SSB	Service Support Boat	28.520443	95.026386	0	10.668	728	15.24	0.37	0.15	0.05	0.15	0.05	3.20	1.09	2.49	0.21	0.07	0	0
LHB	Line Hose Boat	28.540651	95.019298	0	10.668	728	15.24	0.37	0.06	0.02	0.06	0.02	1.20	0.42	0.93	0.08	0.03	0	0

[1] Based on base elevation designation.

3.0 METHODOLOGY

3.1 OCD Model

Dispersion modeling was performed using the Offshore and Coastal Dispersion (OCD) model (Version 5.0, November 1997). This model simulates effects of offshore emissions from point, area, or line sources on the air quality of coastal regions and is preferred for analyzing over-water pollutant transport. The OCD Model is the preferred model by the US EPA for performing PSD-related modeling for offshore stationary sources.

Averaging periods for each of the pollutants modeled, along with the pollutant's PSD significance level, monitoring exemption level, increment consumption standard, and National Ambient Air Quality Standard (NAAQS) are shown in Table 3-1.

Table 3-1: PSD Significance, Monitoring De Minimis, Increment Consumption, and NAAQS

Averaging Period	$PM_{2.5}$ (ug/m^3)	PM_{10} (ug/m^3)	NO_2 (ug/m^3)	SO_2 (ug/m^3)	CO (ug/m^3)
	Significance Level				
Annual	0.2	1	1	1	---
24-hour	1.2	5	---	5	---
8-hour	---	---	---	---	500
3-hour	---	---	---	25	---
1-hour	---	---	7.5	7.8	2,000
	Monitoring De Minimis Concentration				
Annual	---	---	14	---	---
24-hour	0 [1]	10	---	13	---
8-hour	---	---	---	---	575
1-hour	---	---	---	---	---
	Increment Consumption Standard				
Annual	4	17	25	20	---
24-hour	9	30	---	91	---
8-hour	---	---	---	---	---
3-hour	---	---	---	512	----
1-hour	---	---	---	---	----
	NAAQS				
Annual	12	---	100	80	---
24-hour	35	150	---	365	---
8-hour	---	---	---	---	10,000
3-hour	---	---	---	1300	---
1-hour	---	---	188	196	40,000

[1] The Monitoring De Minimis Concentration for $PM_{2.5}$ 24-hour averaging period was vacated in January 2013.

3.2 Meteorological Data

The OCD model requires both over-land and over-water meteorological data. The following meteorological dataset has been preprocessed by BOEM in accordance with the Five-*Year Meteorological Datasets for CALMET/CALPUFF and OCD5 Modeling of the Gulf of Mexico Region*[3] and used in the modeling analysis:

- OCD Group: 3a (i.e., northeastern portion of the Texas Gulf Coast)
- Buoy: 42035
- Surface data: Port Arthur National Weather Service (NWS) Station
- Upper-air data: Lake Charles NWS Station

This dataset was chosen based on the proximity of the surface stations. The proposed Project will be located nearer the Port Arthur, TX station than the Corpus Christi, TX station. The dataset includes buoy, onshore surface, and onshore upper-air sites pre-processed for OCD5 meteorological input data files. For the modeling analyses, five consecutive years of meteorological data, from 2000-2004, were used.

3.3 Receptor Grid

A receptor grid was developed with a starting point for the receptors located at the ambient air boundary. The ambient air boundary for TGL is defined as the Area-to-be-Avoided (ATBA). Surrounding the platform and VLCCs on each SPM will be safety zones (for a total of three zones) to exclude and restrict non-project vessel operations. The outline of each of the three safety zones is identified as the ATBA. These non-project vessels will not be allowed to anchor within the safety zone/ABA boundary. The established safety zone/ATBA will be monitored via the port control center, vessel traffic control, and port support vessels.

Discrete receptors were placed at 100-meter intervals along the facility's ambient air boundary as described above. Additional receptors were placed at 500-meter intervals from the fence line out to five kilometers. This receptor grid is sufficient to identify the location of the maximum off-property concentration for each modeled pollutant.

3.4 Terrain

The proposed Texas GulfLink Deepwater Port facility stationary emissions source will be located approximately 30 nautical miles off the coast of Texas in the Gulf of Mexico. Receptors are located over water surrounding the offshore facility. Therefore, the entire modeling domain is located completely over water in the Gulf of Mexico. According to US EPA and BOEM modeling guidance, overwater and shoreline is considered flat terrain. Therefore, the elevations for receptors were set to zero height for the modeling analysis.

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[3] Five-Year Meteorological Datasets for CALMET/CALPUFF and OCD5 Modeling of the Gulf of Mexico Region, OCS Study, MMS 2008-029, New Orleans, July 2008.

3.5 Building Downwash

Building downwash accounts for the effects of nearby structures on the flow of emissions from their respective release structures. For this modeling analysis, typical platform building heights and dimensions were input. Base elevations for the platform's buildings were assumed the height of the platform above the water.

4.0 SIGNIFICANT IMPACT ANALYSIS

Screening runs were conducted to determine whether the net emission increase of each pollutant could cause a significant impact and whether pre-construction monitoring would be required. Appendix A contains the electronic modeling files generated for these analyses.

In the significant impact analysis, the project emissions of NO_x, CO, PM_{10}/$PM_{2.5}$, and SO_2 were evaluated to determine whether they have the potential for a significant impact. The project emissions for each pollutant and applicable averaging period were modeled and compared to the pollutant's defined significant impact level (SIL).

The US Court of Appeals decided to vacate and remand 40 CFR 51.166(k)(2) based on the US EPA's lack of authority to exempt sources from the requirements of the Federal Clean Air Act when it established SILs for $PM_{2.5}$. Therefore, an analysis was conducted to justify the use of the SILs in the screening analysis. This analysis was based on comparing the difference between the NAAQS and the measured background concentrations to the SIL. If the difference between the NAAQS and the background concentration is greater than the SIL, it is concluded that the SIL is acceptable to be used to determine if a cumulative impact analysis is necessary. The analysis is as follows:

Table 4-1: $PM_{2.5}$ SIL Justification

$PM_{2.5}$ Averaging Period	NAAQS (ug/m^3)	Galveston Monitor 48-167-1034 Average 2016 through 2018 (ug/m^3)	Difference (NAAQS – Monitor) (ug/m^3)	$PM_{2.5}$ SIL (ug/m^3)	Greater Than SIL?
24-Hour	35	21.7	13.3	1.2	Yes
Annual	12	7.2	4.8	0.3	Yes

Per US EPA guidance, all predicted impacts for annual NO_2, PM_{10}/$PM_{2.5}$, and SO_2 are reported as the high-first-high of the modeled concentrations predicted each year at each receptor based on five years of National Weather Service (NWS) overland meteorological data and buoy overwater meteorological data.

Per US EPA guidance, in the screening analysis, predicted impacts for 1-hour NO_2, 24-hour $PM_{2.5}$, and 1-hour SO_2 are reported as the highest of the five-year averages of the maximum modeled concentrations predicted each year at each receptor based on five years of meteorological data. While the NAAQS for annual PM_{10} has been revoked, the annual PM_{10} PSD increment standard remains in effect. Therefore, a comparison to the SIL for annual PM_{10} was performed to determine if an annual PM_{10} PSD increment analysis is required.

For the remaining pollutants/averaging time combinations (i.e., CO 1-hour and 8-hour, PM_{10} 24-hour, and SO_2 3-hour and 24-hour), predicted impacts are reported as the high-first-high of the modeled concentrations predicted each year at each receptor based on five years of meteorological data.

As part of the assessment of off-site impacts from $PM_{2.5}$, secondary formation of $PM_{2.5}$ attributed to emissions of SO_2 and NO_x must be addressed. The US EPA has developed a method to estimate single source impacts of secondary pollutants as a Tier 1 approach. This assessment is contained in the US EPA's guidance document for using the Modeled Emission Rates for Precursors (MERPs) approach.[4] As described in more detail in Section 6.0 of this report, the guidance uses existing empirical relationships between precursors and secondary impacts. A MERP is defined as an emission rate of a precursor that is expected to result in a change in the ambient ozone or $PM_{2.5}$ that would be less than a specific air quality concentration threshold for ozone or $PM_{2.5}$. MERPs for each precursor may be based on either the most conservative (lowest) values across a region/area or the source-specific value derived from a more similar hypothetical source modeled by a permit applicant, permitting authority, or US EPA.

4.1 Preconstruction Monitoring De Minimis Levels

The results of the preliminary analysis were compared to the preconstruction monitoring exemption levels. As described in the following paragraphs and tables, the results indicated no concentrations equal to or greater than the monitoring exemption level for any modeled pollutant with a preconstruction monitoring exemption concentration

The significant monitoring concentration level for the 24-hour averaging period for $PM_{2.5}$ was vacated in January 2013, essentially establishing the level as zero. As a result, $PM_{2.5}$ data from the US EPA Galveston monitoring station was used to address the preconstruction monitoring requirements.

4.2 Carbon Monoxide (CO) Modeling

The maximum concentrations predicted by the screening modeling runs for CO are shown in Table 4-2. The modeling results indicate that the maximum offsite concentrations of CO were below the respective PSD modeling significant impact levels and preconstruction monitoring exemption levels. Therefore, a cumulative impact analysis for CO was not required.

[4] *Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ Under the PSD Permitting Program* (EPA-454/R-16-006, December 2016).

Table 4-2: Screening Analysis Results for CO

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration (ug/m^3)	Significant Impact Level (ug/m^3)	Monitoring Exemption Level (8-hour) (ug/m^3)
CO	2000	1-Hour	162	2,000	NA
CO	2001	1-Hour	179	2,000	NA
CO	2002	1-Hour	173	2,000	NA
CO	2003	1-Hour	172	2,000	NA
CO	2004	1-Hour	165	2,000	NA
CO	2000	8- Hour	59	500	575
CO	2001	8- Hour	67	500	575
CO	2002	8- Hour	96	500	575
CO	2003	8- Hour	64	500	575
CO	2004	8- Hour	70	500	575

4.3 Nitrogen Dioxide (NO_2) Modeling

The maximum concentrations predicted by the screening modeling runs for NO_2 are shown in Table 4-3. The modeling results for the 1-hour NO_2 and annual averaging periods indicate that the maximum off-site concentrations were above the PSD modeling significant impact level for each averaging period. Therefore, a cumulative impact analysis for NO_2 was required.

Results of the annual averaging period are below the monitoring exemption level. Therefore, preconstruction monitoring is not required for NO_2 based on its annual averaging period.

Table 4-3: Screening Analysis Results for NO_2

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration (ug/m^3)	Significance Impact Level (ug/m^3)	Monitoring Exemption Level (ug/m^3)
NO_2	2000 - 2004	1-Hour 5-Year Avg	261.77	7.5	NA
NO_2	2000	1-Hour	262.19		
NO_2	2001	1-Hour	264.69		
NO_2	2002	1-Hour	261.22		
NO_2	2003	1-Hour	257.64		
NO_2	2004	1-Hour	263.10		
NO_2	2000	Annual	3.69	1	14
NO_2	2001	Annual	3.18	1	14
NO_2	2002	Annual	3.40	1	14
NO_2	2003	Annual	3.58	1	14
NO_2	2004	Annual	4.27	1	14

4.4 Particulate Matter (less than 10 microns) (PM_{10}) Modeling

The maximum concentrations predicted by the screening modeling runs for PM_{10} are shown in Table 4-4. The modeling results for both PM_{10} averaging periods, 24-hour and annual, indicate that the maximum off-site concentrations are below the PSD modeling significant impact levels. Therefore, a cumulative impact analysis was not required for these averaging periods. In addition, results of the PM_{10} screening analysis showed no exceedances of the monitoring exemption level for the 24-hour averaging period. As such, a preconstruction monitoring analysis was not required for this pollutant.

Table 4-4: Screening Analysis Results for PM_{10}

Pollutant	**Meteorological Year**	**Averaging Period**	**Modeled Concentration** (ug/m^3)	**Significance Impact Level** (ug/m^3)	**Monitoring Exemption Level (24-hour)** (ug/m^3)
PM_{10}	2000	24-Hour	2.48	5	10
PM_{10}	2001	24-Hour	3.07	5	10
PM_{10}	2002	24-Hour	2.48	5	10
PM_{10}	2003	24-Hour	2.66	5	10
PM_{10}	2004	24-Hour	2.43	5	10
PM_{10}	2000	Annual	0.18	1	NA
PM_{10}	2001	Annual	0.25	1	NA
PM_{10}	2002	Annual	0.21	1	NA
PM_{10}	2003	Annual	0.22	1	NA
PM_{10}	2004	Annual	0.20	1	NA

4.5 Particulate Matter (less than 2.5 microns) ($PM_{2.5}$) Modeling

The maximum concentrations predicted by the screening modeling runs for $PM_{2.5}$ are shown in Table 4-5. The modeling results for the $PM_{2.5}$ annual averaging period indicate that the maximum off-site concentrations are below the PSD modeling significant impact level. Therefore, a cumulative impact analysis is not required for this averaging period. However, the modeling results for the 24-hour $PM_{2.5}$ averaging period indicate that the maximum off-site concentrations were above the PSD modeling significant impact level. Therefore, a cumulative impact analysis for $PM_{2.5}$ 24-hour was required.

Table 4-5: Screening Analysis Results for $PM_{2.5}$

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration (ug/m^3)	Significance Impact Level (ug/m^3)	Monitoring Exemption Level (24-hour) (ug/m^3)
$PM_{2.5}$	2000	24-Hour	2.48	1.2	NA
$PM_{2.5}$	2001	24-Hour	3.07	1.2	NA
$PM_{2.5}$	2002	24-Hour	2.48	1.2	NA
$PM_{2.5}$	2003	24-Hour	2.66	1.2	NA
$PM_{2.5}$	2004	24-Hour	2.43	1.2	NA
$PM_{2.5}$ 5-year Avg	2000-2004	24-Hour	2.62	1.2	NA
$PM_{2.5}$	2000	Annual	0.11	0.2	NA
$PM_{2.5}$	2001	Annual	0.10	0.2	NA
$PM_{2.5}$	2002	Annual	0.10	0.2	NA
$PM_{2.5}$	2003	Annual	0.11	0.2	NA
$PM_{2.5}$	2004	Annual	0.13	0.2	NA
$PM_{2.5}$ 5-year Avg	2000-2004	Annual	0.11	0.2	NA

4.6 Sulfur Dioxide (SO_2) Modeling

The maximum concentrations predicted by the screening modeling runs for SO_2 are shown in Table 4-6. The modeling results indicate that the maximum off-site concentrations of SO_2 were below the respective PSD modeling significant impact levels and preconstruction monitoring exemption levels for all averaging periods except the 1-hour average. Therefore, a cumulative impact analysis for SO_2 3-hour, 24-hour, and annual was not required. The modeling results for the 1-hour SO_2 averaging period indicates that the maximum off-site concentrations were above the PSD modeling significant impact level. Therefore, a cumulative impact analysis for SO_2 was required.

Table 4-6: Screening Analysis Results for SO_2

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration (ug/m^3)	Significant Impact Level (ug/m^3)	Monitoring Exemption Level (ug/m^3)
SO_2	2000	1-Hour	14.07	7.8	NA
SO_2	2001	1-Hour	14.45	7.8	NA
SO_2	2002	1-Hour	14.03	7.8	NA
SO_2	2003	1-Hour	13.96	7.8	NA
SO_2	2004	1-Hour	14.14	7.8	NA

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration (ug/m^3)	Significant Impact Level (ug/m^3)	Monitoring Exemption Level (ug/m^3)
SO_2	2000	3- Hour	9.79	25	NA
SO_2	2001	3- Hour	10.71	25	NA
SO_2	2002	3- Hour	10.71	25	NA
SO_2	2003	3- Hour	11.3	25	NA
SO_2	2004	3- Hour	10.97	25	NA
SO_2	2000	24-Hour	3.39	5	13
SO_2	2001	24-Hour	4.36	5	13
SO_2	2002	24-Hour	3.46	5	13
SO_2	2003	24-Hour	4.35	5	13
SO_2	2004	24-Hour	4.11	5	13
SO_2	2000	Annual	0.30	1	NA
SO_2	2001	Annual	0.35	1	NA
SO_2	2002	Annual	0.29	1	NA
SO_2	2003	Annual	0.31	1	NA
SO_2	2004	Annual	0.33	1	NA

5.0 CUMULATIVE IMPACT ANALYSIS

The intent of the cumulative impact analysis is to determine if the proposed project causes or contributes to a violation of either the NAAQS or PSD Increment Consumption standards. For the pollutant/averaging periods requiring a NAAQS analysis, the form of the standard is given in the table below:

Table 5-1: Form of NAAQS Analysis

Pollutant	Averaging Period	Form of the NAAQS
$PM_{2.5}$	24-Hour	98^{th} Percentile averaged over 3 years
SO_2	1-Hour	99^{th} Percentile of the 1-hour daily maximum concentrations, averaged over 3 years
NO_2	1-Hour	98^{th} Percentile of the 1-hour daily maximum concentrations, averaged over 3 years
	Annual	Annual Mean

The OCD model does not have the capability of calculating the 98-percentile of the 1-hour daily maximum concentrations of NO_2. Therefore, a post-processor program was written to calculate these values from the 1-hour OCD model results. In addition, the Ambient Air Ratio (ARM) of 0.8 was applied to the results of the 1-hour NO_2 concentrations for the cumulative analysis to account for the conversion of NO_x to NO_2. As a conservative measure, for the results of the annual NOx cumulative analysis, a Tier 1 full conversion of NO_x to NO_2 was assumed. In addition, for the results of the 24-hour $PM_{2.5}$ and the 1-hour SO_2 cumulative analyses, the high-first-high concentrations, plus background, were compared to the NAAQS and Increment Consumption Standards, as applicable. Appendix A contains the electronic modeling files for these analyses.

5.1 Emissions Sources

Off-site emission sources for the cumulative impact analyses were included in the model for the NAAQS and increment consumption analysis. Sources within 50 kilometers of the facility were included for the NO_2, SO_2 and $PM_{2.5}$ analyses and were obtained from the 2014 BOEM Gulf-wide Emission Inventory. Table 5-2 lists the off-site sources included in the model.

Table 5-2: Off-Site Sources for Cumulative Impact Analyses

Source ID	Source Description	Latitude Decimal Degrees	Longitude Decimal Degrees	Base Elevation (m)	Stack Height Above Platform or Water (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)	$PM_{2.5}$ Emissions 24-hr (g/s)	NO_2 Emissions 1-hr (g/s)	NO_2 Emissions Annual (g/s)	SO_2 Emissions 1-hr (g/s)
2222_1	Boiler - Max MMBTU/hr < 10-natural gas	28.15999985	94.73999786	0	24.38	478	2.81	0.30	0.0003	0.0054	0.0052	0.00003
2222_2	Diesel Engine – Max HP < 600-diesel	28.15999985	94.73999786	0	24.38	755	11.01	0.15	0.0193	0.2741	0.0008	0.018
2222_3	Natural Gas Engine - 4-stroke, rich	28.15999985	94.73999786	0	24.38	866	18.35	0.15	0.0031	0.4054	0.2460	0.0001
2428	Diesel Engine – Max HP < 600-diesel	28.19000053	94.76000214	0	24.38	755	11.01	0.15	0.0193	0.2741	0.0003	0.018
2222_1	Boiler - Max MMBTU/hr < 10-natural gas	28.15999985	94.73999786	0	24.38	478	2.81	0.30	0.0003	0.0054	0.0052	0.00003

5.2 NAAQS Comparison

Maximum hourly potential-to-emit (PTE) emission rates were modeled for comparison with short-term averaging periods. In addition to the permitted inventory of emission sources, background concentrations from a representative monitor were entered into the model to determine total pollutant concentrations for comparison to the NAAQS.

Ambient air concentrations were obtained from the monitoring stations as shown below in Table 5-3. The resulting concentration from the modeling runs were compared to the NAAQS for each averaging period. If the modeled concentration plus background was equal to or greater than the NAAQS, a culpability analysis was performed to determine the facility's contribution to the exceedance.

Table 5-3: Ambient Air Quality Monitoring Sites

Pollutant	Name of Monitoring Site	AQS Code
$PM_{2.5}$	Galveston	48-167-1034
NO_2	Lake Jackson	48-039-1016
O_3	Lake Jackson	48-039-1016
SO_2	Texas City Ball Park	48-167-0005

5.3 Increment Consumption Analysis

The pollutant/averaging period combinations exceeding the SIL which have Increment Consumption Standards are as follows:

- NO_2 annual average
- $PM_{2.5}$ 24-hour average

For both the $PM_{2.5}$ and NO_2 increment consumption analysis, the NAAQS inventory was used as a Tier 1 conservative approach, which included permitted allowable emissions instead of actuals without subtracting baseline emissions.

5.4 Background Air Quality Data

Monitoring data was used to establish background concentrations required for the NAAQS analysis. Site-specific ambient air monitoring data were not available. Therefore, US EPA's AirData system was used to obtain background ambient concentrations of affected pollutants. This data was taken from the US EPA monitoring data website at: https://www.epa.gov/air-data. Because a cumulative impact analysis was required for NO_2 (1-hour and annual averages), existing monitoring data from the Lake Jackson, TX air monitoring facility was used. For the $PM_{2.5}$ and SO_2 cumulative impact analyses, the Galveston and Texas City Ball Park monitors, respectively, were used. Ozone background concentrations, which were used in the Ozone Impacts Analysis described in Section 8.0 of this report, were also derived from the Lake Jackson monitor.

The monitors chosen were reviewed for sufficient data to meet the completeness criteria. A year meets the completeness criteria if at least 75% of the scheduled samples per quarter were reported. The most recent three consecutive available years, 2016 through 2018, were analyzed. The 2018 $PM_{2.5}$ Galveston monitoring data contained a quarter less than 75% complete. Therefore, the years of 2015 – 2017 were analyzed for completeness and utilized. The 2017 SO_2 Texas City Ball Park monitoring data contained a quarter less than 75% complete. Therefore, the years of 2014 – 2016 were analyzed for completeness and utilized. Information on the monitoring station used is shown in Table 5-4 below.

Per the TCEQ Guidelines, "The purpose of the representative background monitoring concentrations is to account for sources not explicitly modeled in an air dispersion modeling analysis." As the proposed project is located approximately 28 nautical miles off the Texas coast, the available monitors in and near Galveston, TX were considered for use. An evaluation of the monitors chosen was conducted to ensure that each monitor resulted in a conservative selection for use as background concentration data. Because the proposed site is located in open waters with only two known nearby platforms to exist, each approximately 50 kilometers (approximately 31 miles) away, any monitor with some level of commercial or industrial contribution of the monitored pollutant would be conservative to apply as background in this modeling analysis.

The nearest monitor with NO_2 data to the proposed offshore facility is Lake Jackson (AQS Site ID: 48-039-1016) in Brazoria County, TX. This station is located west of the city of Lake Jackson and northwest of the city of Freeport. The Lake Jackson monitor location is adjacent to Highway 2004 near the intersection of Highway 332. This monitor is also within a half mile of a large commercial shopping area and approximately 1 mile from the Nolan Ryan Expressway (Hwy 288), which is a heavily traveled thoroughfare between Houston and Freeport. The influences of these nearby highways and population centers to the Lake Jackson monitor are considered relatively much greater than the influences to the proposed Texas GulfLink facility of the 2 platforms located over 30 miles from the facility. Therefore, use of concentration data from the Lake Jackson monitor for the project offshore modeling is deemed conservative and appropriate.

The nearest monitor to the proposed facility with $PM_{2.5}$ data is located in Galveston, TX (AQS Site ID: 48-167-1034) in Galveston County. This station is located on Galveston Island just south of Runway 36 at the Scholes International Airport. Numerous additional commercial and residential influences exist surrounding the monitor location. These influences to the Galveston monitor are considered much greater than the influences to the proposed Texas GulfLink facility from the 2 platforms located over 30 miles from the proposed facility. Therefore, use of concentration data from the Galveston monitor is deemed conservative and appropriate.

The nearest monitor to the proposed facility with SO_2 data is Texas City Ball Park (AQS Site ID: 48-167-0005) in Galveston County. This station is located in Texas City, TX approximately a quarter mile north of a heavily industrialized area mainly consisting of chemical and petroleum production operations and product tankage. This nearby industry is considered to have much greater influences on the Texas City Ball Park monitor than influences to the proposed Texas GulfLink facility from the 2 platforms located over 30 miles away from the proposed facility. Therefore, use of concentration data from the Texas City Ball Park monitor is deemed conservative and appropriate.

Table 5-4: Monitoring Data

Compound	Monitor Name	AQS Code	Year	Percent Valid Data				Value Rank	Concentration (ppb)	Concentration (µg/m³)	3-Year Average Concentration (µg/m³)
				Q1	Q2	Q3	Q4				
$PM_{2.5}$	Galveston	48-167-1034	2015	93%	79%	99%	100%	98th Percentile 24-Hour		22.5	21.67
			2016	100%	99%	100%	87%			19.3	
			2017	93%	100%	86%	100%			23.2	
NO_2	Lake Jackson	48-039-1016	2016	93%	90%	94%	94%	98th Percentile 1-Hour	19	35.8	35.2
			2017	94%	96%	80%	91%		18.9	35.6	
			2018	96%	94%	95%	82%		18.2	34.2	
O_3	Lake Jackson	48-039-1016	2016	97%	99%	100%	95%	99th Percentile 8-Hour	66	130	66 [1]
			2017	98%	99%	83%	98%		65	128	
			2018	99%	99%	99%	99%		68	133	
SO_2	Texas City Ball Park	48-167-0005	2014	99%	95%	97%	96%	99th Percentile 1-Hour	16	41.9	59.2
			2015	97%	98%	98%	98%		29.1	76.2	
			2016	98%	98%	98%	98%		22.7	59.4	

[1] parts per billion (ppb)

5.5 NO_2 NAAQS Comparison

The results of the 1-hour NO_2 NAAQS analysis, which includes the background NO_2 concentration, are shown in Table 5-5 below:

Table 5-5: NAAQS for NO_2 1-Hour Standard

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration Max Daily 8th High All Sources (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	NO_2 NAAQS Standard 1-Hour (ug/m^3)
NO_2	2000 - 2004	1-Hour 5-Year Avg	140.54	35.2	175.74	188
NO_2	2000	1-Hour	136.6			
NO_2	2001	1-Hour	139.79			
NO_2	2002	1-Hour	139.92			
NO_2	2003	1-Hour	146.63			
NO_2	2004	1-Hour	139.74			

The results of the annual NO_2 NAAQS, which includes the background NO_2 concentration, are shown in Table 5-6 below:

Table 5-6: NAAQS for NO_2 Annual Standard

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration Annual Average All Sources (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	NO_2 NAAQS Standard Annual (ug/m^3)
NO_2	2000	Annual	3.70	3.84	7.54	100
NO_2	2001	Annual	3.19		7.03	
NO_2	2002	Annual	3.41		7.25	
NO_2	2003	Annual	3.59		7.43	
NO_2	2004	Annual	4.27		8.11	

5.6 $PM_{2.5}$ NAAQS Comparison

The results of the 24-hour NAAQS which includes the background $PM_{2.5}$ concentration are shown in Table 5-7 below:

Table 5-7: NAAQS for $PM_{2.5}$ 24-Hour Standard

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration High-First-High All Sources (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	$PM_{2.5}$ NAAQS Standard 24-Hour (ug/m^3)
PM_{25}	2000 - 2004	24-Hour 5-Year Avg	2.62	21.67	24.29	35
PM_{25}	2000	24-Hour	2.48			
PM_{25}	2001	24-Hour	3.07			
PM_{25}	2002	24-Hour	2.48			
PM_{25}	2003	24-Hour	2.66			
PM_{25}	2004	24-Hour	2.43			

Secondary $PM_{2.5}$ formation as it relates to the results above are discussed in detail in Section 6.0. The results indicated no exceedance of the 24-hour $PM_{2.5}$ NAAQS and, therefore, the proposed project has demonstrated compliance with the $PM_{2.5}$ NAAQS.

5.7 SO_2 NAAQS Comparison

The results of the 1-hour SO_2 NAAQS, which includes the background SO_2 concentration, are shown in Table 5-8 below:

Table 5-8: NAAQS for SO_2 1-Hour Standard

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration High-First-High All Sources (ug/m^3)	Background Concentration (ug/m^3)	Total Concentration (ug/m^3)	SO_2 NAAQS Standard 1-Hour (ug/m^3)
SO_2	2000 - 2004	1-Hour 5-Year Avg	14.13	59.2	73.33	196
SO_2	2000	1-Hour	14.07			
SO_2	2001	1-Hour	14.45			
SO_2	2002	1-Hour	14.03			
SO_2	2003	1-Hour	13.96			
SO_2	2004	1-Hour	14.14			

5.8 $PM_{2.5}$ Increment Consumption Comparison

The results of the 24-hour $PM_{2.5}$ increment consumption analysis, as shown in Table 5-9, demonstrate compliance with the increment consumption standard.

Table 5-9: Increment Consumption for $PM_{2.5}$ 24-Hour Standard

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration 24-Hour Average High-First-High (ug/m^3)	Increment Consumption Standard $PM_{2.5}$ (ug/m^3)
$PM_{2.5}$	2000	24-Hour	2.48	9
$PM_{2.5}$	2001	24-Hour	3.07	9
$PM_{2.5}$	2002	24-Hour	2.48	9
$PM_{2.5}$	2003	24-Hour	2.66	9
$PM_{2.5}$	2004	24-Hour	2.43	9

Secondary $PM_{2.5}$ formation as it relates to the results above are discussed in detail in Section 6.0. The results indicated no exceedance of the 24-hour $PM_{2.5}$ Increment Consumption standard, and therefore, the proposed project has demonstrated compliance with the $PM_{2.5}$ Increment Consumption.

6.0 $PM_{2.5}$ SECONDARY FORMATION

As part of the assessment of off-site impacts from $PM_{2.5}$, secondary formation of $PM_{2.5}$ attributed to emissions of SO_2 and NO_x must be addressed. As previously described, the US EPA has developed a method to estimate single source impacts of secondary pollutants as a Tier 1 approach. This assessment is contained in the previously referenced US EPA's guidance document on modeling using the MERPs approach. The guidance uses existing empirical relationships between precursors and secondary impacts. A MERP is defined as an emission rate of a precursor that is expected to result in a change in the ambient ozone or $PM_{2.5}$ that would be less than a specific air quality concentration threshold for ozone or $PM_{2.5}$. MERPs for each precursor may be based on either the most conservative (lowest) values across a region/area or the source-specific value derived from a more similar hypothetical source modeled by a permit applicant, permitting authority, or US EPA.

For the $PM_{2.5}$ 24-hour precursor assessment, only NO_x emissions are above the level of the significant emission rate requiring a PSD compliance demonstration. The proposed annual NO_x (expressed as NO_2) emissions from the project, 961.74 tons per year (TPY), were compared to Table 7.1 of the guidance document, *Table 7.1 Most Conservative (lowest) Illustrative MERP Values (tons per year) by Precursor, Pollutant and Region.* For the Central US, the lowest NO_x MERP for daily PM is 1,820 TPY. The NO_x emissions from the proposed Texas GulfLink Project are below this value. Therefore, air quality impacts of $PM_{2.5}$ from NO_x would be expected to be below the critical air quality concentration (CAC) threshold.

In addition, calculating a source-specific value derived from a more similar hypothetical source modeled by EPA results in an even lower value as shown below:

> Hypothetical source for NO_x – (Central US, Source 20, elevated, 1,000 TPY, FIPS 48201). This source is located in Harris County, Texas.
>
> MERP = 1.2 ug/m^3 * (1,000 TPY / 0.09) = 11,111 TPY
>
> Percentage of MERP = (961.74 TPY NO_x / 11,111 TPY MERP) = 8.7% of MERP

Proposed TGL DWP NO_x emissions are 8.7% of the MERP. Adding 8.7% to the maximum concentration calculated in the NAAQS analysis for 24-hour $PM_{2.5}$ of 2.62 ug/m^3 would not cause an exceedance of the NAAQS. Additionally, adding 8.7% to the maximum concentration calculated in the Increment Consumption analysis for 24-hour $PM_{2.5}$ of 3.07 ug/m^3 would not cause an exceedance of the Increment Consumption Standard.

For the $PM_{2.5}$ annual precursor assessment, the proposed NO_x emissions from the project in TPY were compared to Table 7.1 of the aforementioned guidance document, *Table 7.1 Most Conservative (lowest) Illustrative MERP Values (tons per year) by Precursor, Pollutant and Region.* For the Central US, the lowest NO_x MERP for annual PM is 7,427 TPY. The NO_x emissions from the Project are well below this value. Therefore, air quality impacts of $PM_{2.5}$ from NO_x would be expected to be below the CAC threshold. Proposed TGL DWP NO_x emissions are 13% of the MERP. Adding 13% to the maximum concentration calculated in the significant impact analysis model for annual $PM_{2.5}$ of 0.11 ug/m^3 would not cause an exceedance of the SIL.

This analysis demonstrates that the total $PM_{2.5}$ impacts (primary and precursor) are below the CAC.

7.0 VISIBILITY IMPAREMENT ANALYSIS

The US EPA's workbook on visual impact screening[5] provides guidance for conducting impairment analysis using the US EPA VISCREEN model. A visibility analysis was conducted using US EPA's VISCREEN model on the nearest Class II area, which is the San Bernard National Wildlife Refuge. This area is approximately 68 kilometers from the proposed Texas GulfLink Project.

A Level 1 analysis was conducted using the Project's potential tons per year (TPY) emission rate for particulate matter ($PM_{10/2.5}$) and nitrogen oxides (NO_x) that could occur simultaneously. Based on regulatory guidance related to Level 1 analysis, all default options in the model were used. Level 1 screening is designed to provide a conservative estimate of plume visual impacts based on worst-case meteorological conditions: stable atmosphere ("F" Stability), wind speed of 1 meter per second (m/s) persisting for 12 hours, with a wind that would transport the plume directly adjacent to the observer.

The results of this conservative Level 1 analysis are that the maximum visual impacts meet the screening criteria. The VISCREEN results are included as Appendix B to this modeling report.

[5] Workbook for Plume Visual Impact Screening and Analysis (Revised), EPA-454/R-92-023, October 1992.

8.0 OZONE IMPACT ANALYSIS

Because VOC and NO_x are precursors to ground-level ozone formation, an ozone impacts analysis was conducted to demonstrate that the proposed Project's NO_x and VOC emissions will not cause a significant increase in ozone levels in the area. A Tier 1 MERP analysis was conducted using the US EPA's guidelines for MERPs, EPA-454/ R-16-006, December 2016 (see Footnote 4 in Section 4.0 above).

NO_x Assessment

A source-specific value derived from a similar hypothetical source modeled by US EPA was determined for potential ozone formation due to Project NO_x as shown below. The critical air quality concentration (CAC) used was the difference between the ozone design value and the 3-year average monitoring data from the Lake Jackson monitor:

Proposed Project Emissions: NO_x – 98.33 TPY

Hypothetical source for NO_x – Central US, Source 20, elevated, 500 TPY, FIPS 48201. This source is located in Harris County, Texas.

MERP = 4.0 ppb * (500 TPY/0.78) = **2,564 TPY**

Note that the NO_x emissions described above do not include secondary emissions from tankers and support vessels.

VOC Assessment

A source-specific value derived from a similar hypothetical source modeled by US EPA was determined for potential ozone formation due to Project VOC as shown below. The CAC used was the difference between the ozone design value and the 3-year average monitoring data from the Lake Jackson monitor:

Proposed Project Emissions: VOC – 9,685.53 TPY

Hypothetical source for VOC – Central US, Source 20, elevated, 3,000 TPY, FIPS 42801. This source is located in Harris County, Texas.

MERP = 4.0 ppb * (3,000 TPY/1.09) = **11,009 TPY**

Note that the VOC emissions described above do not include secondary emissions from tankers and support vessels.

In addition, the VOC and NO_x precursor contributions to ozone are considered together to determine if the Project's air quality impact of ozone would exceed the critical air quality threshold. This analysis is shown below:

Cumulative Impacts for Ozone:

(98.33 TPY NO_x/2,564 TPY MERP) + (9,685.53 TPY VOC/11,009 TPY MERP) = 91.8% of MERP

Results indicate that the proposed precursor emissions from the project are less than 100% indicating that the CAC threshold would not be exceeded when considering the additive impacts of these precursors.

9.0 CLASS I AREA IMPACT ANALYSIS

There are no Class I areas located within 500 kilometers of the proposed Texas GulfLink offshore Deepwater Port facility. The nearest Class I area, Breton National Wildlife Refuge, is located approximately 570 kilometers to the east. Therefore, no Class I analysis was conducted. Given the distance between Breton National Wildlife Refuge and the Project, no Class I increment analysis was conducted.

10.0 STATE PROPERTY LINE ANALYSIS

To meet the requirements of the Deepwater Act (i.e., for nearest adjacent coastal state), a TCEQ State Property Line Analysis was conducted for the proposed offshore facility for applicable sulfur compounds. Hydrogen Sulfide was reviewed and, given its negligible maximum hourly emission rate (0.12 lb/hr), a modeling analysis was not performed.

Because the NAAQS analyses described in Section 5.0 of this report utilized the High-First-High SO_2 results, those results are appropriate for comparison with the State Property Line Standards. One year of meteorological data (most recent year 2004) was used for comparison. Modeling for SO_2 at the Deepwater Port Facility indicates that results will remain well below the State Property Line Standard.

Table 10-1: State Property Line SO_2 Results

Pollutant	Meteorological Year	Averaging Period	Modeled Concentration (ug/m^3)	State Property Line Standard (ug/m^3) [2]
SO_2	2004	30-minute[1]	14.14	1,021

[1] Per TCEQ guidance, use the high first high predicted concentrations for the one hour averaging times.

[2] State property line standard from TCEQ Air Quality Modeling Guidelines (APDG 6232 v4, revised 9/2018), Appendix B Table B-3.

11.0 HEALTH EFFECTS ANALYSIS

The pollutant evaluated in this analysis is defined by TCEQ as "crude oil with a benzene concentration of less than 1 percent". This is the Effects Screening Level (ESL) description. Emissions of crude oil occur at the VLCC's Vent Mast Riser when loading crude into the ship. Stack parameters and emission rates used for this analysis are given in Table 11-1 below. As a conservative measure, the maximum hourly rate was used for both the 1-hour and annual ESL averaging periods.

Table 11-1: Stack Parameters for Health Effects Analysis

Source ID	Source Description	Latitude Decimal Degrees	Longitude Decimal Degrees	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)	VOC Emissions (g/s)
STACK	VLCC Vent Mast Riser	28.541554	94.996868	0	20	298	10.80	0.91	593.40

Modeled concentrations of crude oil were compared to the appropriate ESL for the 1-hour and annual averaging periods. TCEQ published guidelines for Effects Evaluations for Marine Vessels, *"Effects Evaluation Procedure: Marine Vessels, TNRCC Memo, August 2001"* which gives guidance on impacts over water. Specifically, the guidance states that "the max concentration should be less than 25 times the ESL and should not exceed 10 times the ESL more than 24 hours per year. Not more than 10 of those hours should have concentrations which exceed 20 times the ESL."

The results of the State Health Effects Review modeling are shown in Table 11-2. Although there are exceedances of the ESL, they occur at industrial receptors over water. Modeled crude oil concentrations do not exceed 10 times the ESL. Therefore, the modeled magnitudes of impacts and frequency of exceedance are considered acceptable.

Table 11-2: Results of Health Effects Analysis

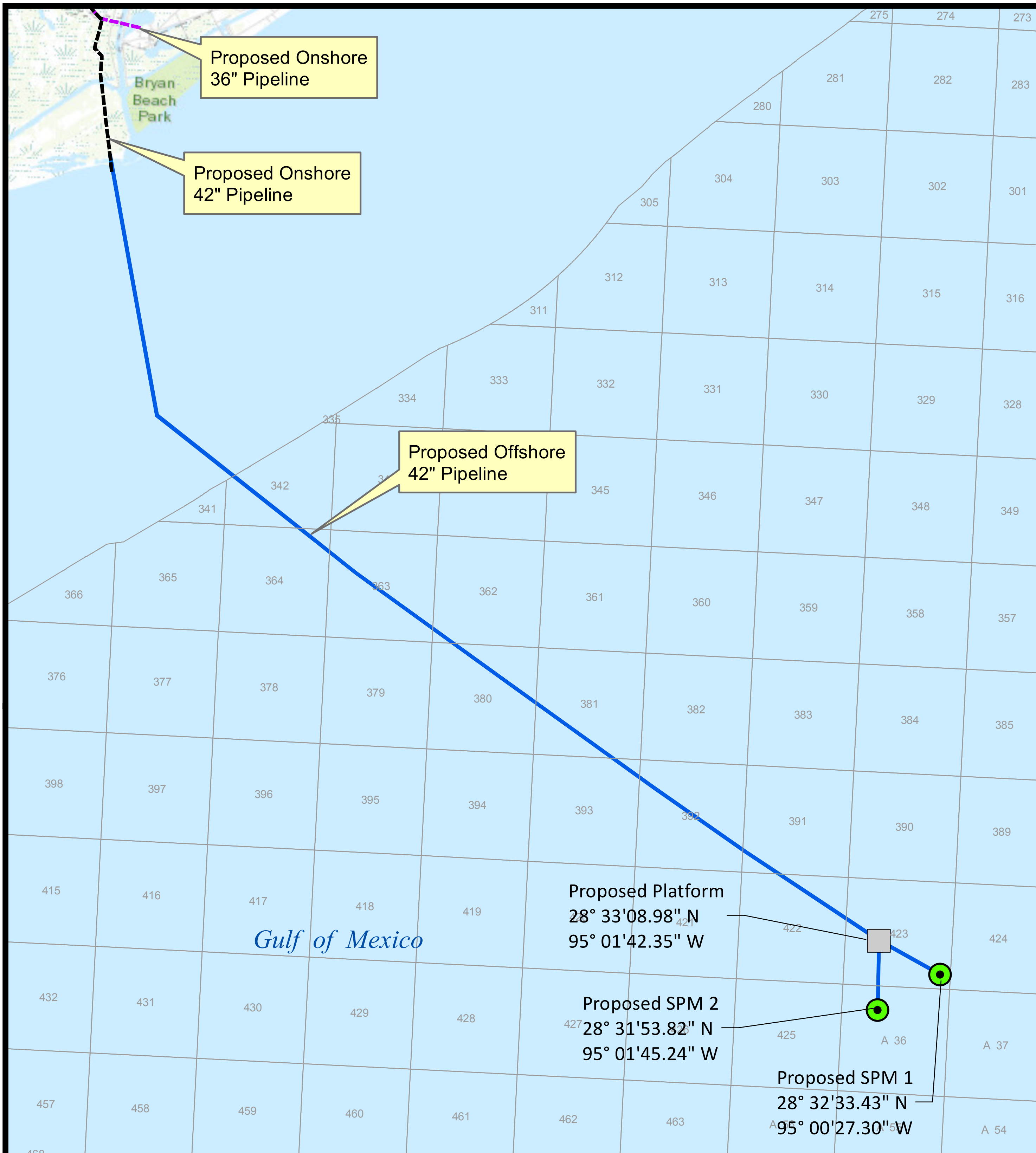
Pollutant	Meteorological Year	Averaging Period	Modeled Concentration[1] (ug/m^3)	ESL Standard (ug/m^3)	Multiple of ESL	10X ESL Exceedance?	20X ESL Exceedance?
Crude Oil Vapor (<1% Benzene)	2004	1-hour	15,799	3,500	4.5	No	No
	2004	Annual	444	350	1.3	No	No

[1]The receptors in the model are industrial receptors over water.

FIGURES

Figure 1

Offshore Site Location Map



Sentinel Midstream
Dallas, Texas

Texas GulfLink

Offshore Location Map

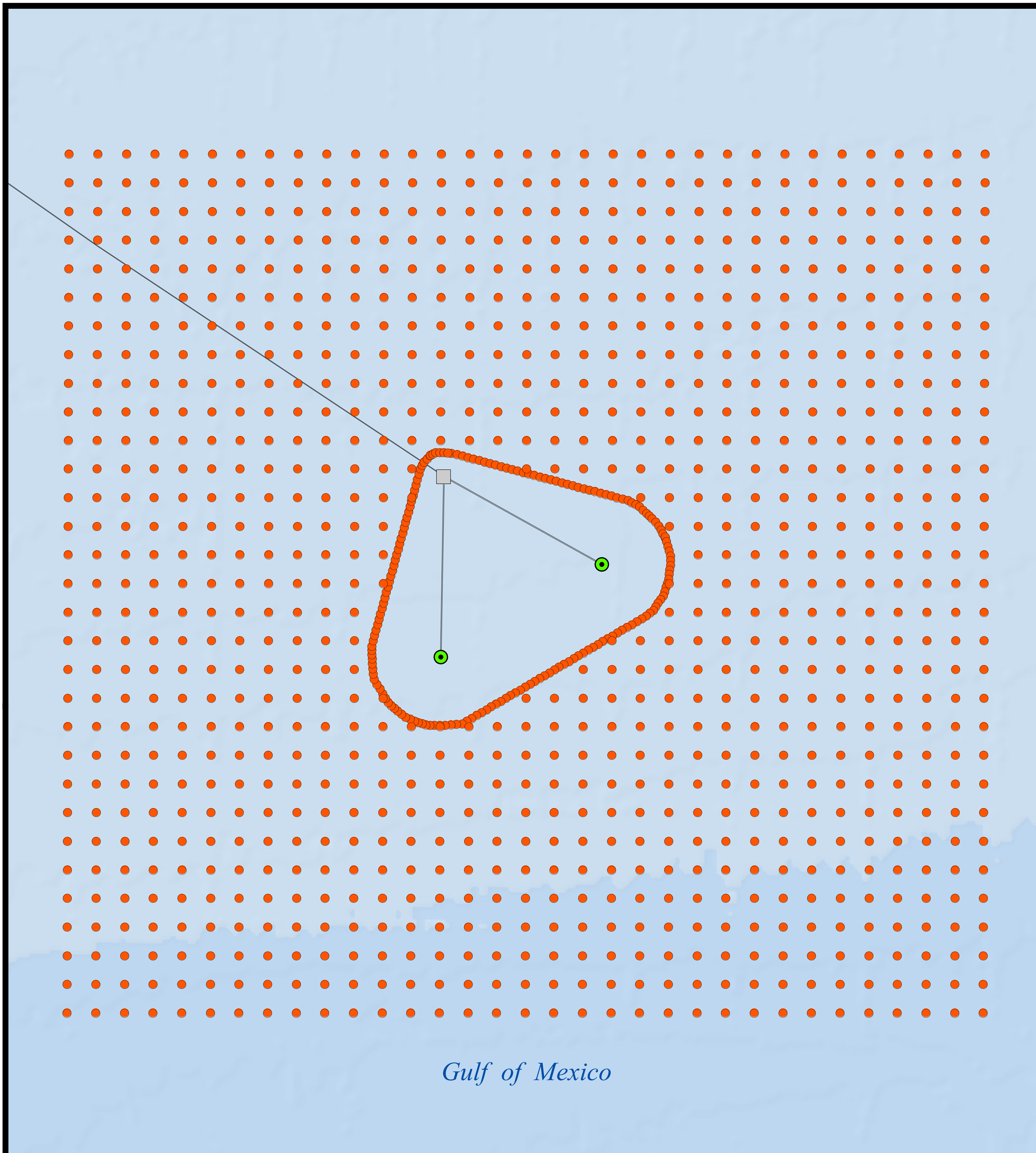
N

0 3 Miles

Drawn:	CPL	Checked:	BLN
Date:	05/03/19	Approved:	TEW
Dwg. No.:	A17073-36	**Figure 1**	

Figure 2

Receptor Locations



Receptor

Proposed Platform

Proposed SPM

Sentinel Midstream
Dallas, Texas

Texas GulfLink

Receptor Grid

N

0 1
Miles

Drawn:	CAL	Checked:	MEH
Date:	12/11/2019	Approved:	JLS
Dwg. No.:	A17073-113	**Figure 2**	

Appendix A

Electronic Modeling Files

OCD modeling input and output files are provided electronically and can be downloaded using the One Drive link below. Access is password protected.

https://cka-my.sharepoint.com/:f:/g/personal/james_smith_c-ka_com/ErALVThiKNpMnsr49cAASjIBzqJD8wRBf3sfwdxT1rbBGQ?e=72qpta

Appendix B

VISCREEN Printout

```
               Visual Effects Screening Analysis for
                 Source: TGL DWP
                 Class II Area: San Bernard Natl Wildlife


                 ***   Level-1 Screening   ***
Input Emissions for

   Particulates    31.32  TON/YR
   NOx (as NO2)   961.74  TON/YR
   Primary NO2      0.00  TON/YR
   Soot             0.00  TON/YR
   Primary SO4      0.00  TON/YR


    **** Default Particle Characteristics Assumed

               Transport Scenario Specifications:

    Background Ozone:                  0.04 ppm
    Background Visual Range:          20.00 km
    Source-Observer Distance:         68.00 km
    Min. Source-Class I Distance:     60.00 km
    Max. Source-Class I Distance:     75.00 km
    Plume-Source-Observer Angle:      11.25 degrees
    Stability:   6
    Wind Speed:   1.00 m/s

                          R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

         Maximum Visual Impacts INSIDE  Class I Area
          Screening Criteria ARE NOT Exceeded
                                  Delta E      Contrast
                                ===========   ============
Backgrnd Theta Azi Distance Alpha Crit  Plume   Crit  Plume
======== ===== === ======== ===== ====  =====   ====  =====
 SKY      10.  75.   65.8    94.  2.00  0.118   0.05 -0.001
 SKY     140.  75.   65.8    94.  2.00  0.036   0.05 -0.001
 TERRAIN  10.  60.   62.2   109.  2.00  0.006   0.05  0.000
 TERRAIN 140.  60.   62.2   109.  2.00  0.002   0.05  0.000


         Maximum Visual Impacts OUTSIDE Class II Area
          Screening Criteria ARE NOT Exceeded
                                  Delta E      Contrast
                                ===========   ============
Backgrnd Theta Azi Distance Alpha Crit  Plume   Crit  Plume
```

========	=====	===	========	=====	====	=====	====	=====
SKY	10.	50.	59.4	119.	2.00	0.091	0.05	-0.001
SKY	140.	50.	59.4	119.	2.00	0.028	0.05	-0.001
TERRAIN	10.	50.	59.4	119.	2.00	0.006	0.05	0.000
TERRAIN	140.	50.	59.4	119.	2.00	0.002	0.05	0.000